ANEXO II – Material didáctico – Dossier del alumno

A continuación se incluye el material didáctico (Dossier de treball/Workbook) desarrollado para los temas (*units*) 1, 2 y 3 de la programación CLIL planteada.

1. UNIT I – ENERGY AND ITS TRANSFORMATION

1.1 Energy

Energy is the capacity of carrying out a work, or also, to cause a change in matter. Nature is full of examples. Look at the following pictures and you'll better understand what is energy about.

As you can see, energy is everywhere around us. For centuries we have learnt to harness it to our benefit. It is safe to say, that where are experts in the use of energy!

1.2 Energy Sources

Therefore, we can obtain energy in many ways. Some of them make good use of the wind, the light and heat coming from the Sun, burning coal or oil derivatives, the force within the ties, water in reservoirs....all of them are energy sources that we can use to our benefit.

Thermal energy is produced by the combustion of oil derivatives or from coal. It generates heat.

Mechanical energy comes from motion, like for example the wind, or water falling down. We can take very good advantage of mechanical energy as you'll see in no time.

Since energy can be produced in many ways, we use an specific term to describe it so that we can identify its source

Energy Source	Term	Renewable/Not renewable
Wind motion	Eolic Energy	R
The Sun		
Energy within substances like coal, gas or oil derivatives		
The combustion of substances like coal, gas or oil derivatives		
Heat generated in Earth	Geothermal	
Water motion		
Tides		
Energy within atoms		

Table I.I Classifying Energy as to the source

Renewable and not renewable energy sources

Non renewable energy sources are those which need substances that are limited on planet Earth. Conversely, renewable energy sources do not depend on limited resources and it can be reused indefinitely.

Having this idea in mind, which of the energy sources in table I.I can be considered as renewable? Us R/NR to identify your option and fill in the table.

1.3 Energy transformation

One of the most incredible things of energy is that it can be transformed into a new kind.

For example, we can transform thermal energy into mechanical energy and again, transform it back in electric energy. This property of energy enables us to generate it in many ways, transport it and use it where needed, like at home or in our industries.

Unit 1 – Energy and its transformation

Activity I – Are you able to define energy?

Having in mind what you know about energy, do this gap fill activity and show your expertise!

Energy is the capacity of _____ but also it can cause a change in _____. We find many examples in Nature, like the light and heat coming from the _____, heat in _____ and the one generated by the _____ when it blows.

Activity 2: Energy transformation

In the following text some parts are missing. Read carefully and complete it the best way possible.

Remember to reread the text once you have finished. Does it make sense?

a) Rubbing two wooden sticks against a wooden base like a trunk motion is converted into heat Mechanical energy is transformed into_____energy.

b) Substances in coal burn easily. This combustion generates heat.

_____energy is transformed into _____ energy.

c) The dynamo of a bicycle becomes handy to ride at night.

We can see that _____energy is transformed into _____energy with which we can see.

Activity 3 – Is it true that…..?

Having in mind what you know about energy and its transformation, try to identify if these statements are true or false:

a) Energy's able to transform, but we only can generate it in one way.
b) We can consider solar energy as the light and heat coming from the Sun.
c) Hydraulic energy can be transformed into electric energy.
d) Eolic energy and atomic energy are produced by similar energy sources.
e) We have access to electricity at home because we can transform and transport energy from a variety of energy sources.

Activity 4 – The energetic potato

It so happens that a good friend of mine and very well-read in the topic of energy, told me some days ago that it's possible to light a little led with a potato

-Are you nuts, Nelson? I told him.

He didn't like my reaction, so he wouldn't tell me the secret. Can you please help me?

Having in mind what you know about energy and its transformation and making good use of the internet try to explain how is it possible to light a led with a potato. What two energies take part of the experiment?

If you want, you can also sketch up a diagram showing how to do it.

Unit I - Useful glossary

Carry out (v): dur a terme, realitzar, fer una tasca
Everywhere (adv): a tot arreu
Coal (n): carbó
Oil derivatives (cn): derivats del petrol
Thermal energy (cn): energia tèrmica
Renewable (adj): removable
Trunk: tronc
Coal: carbó
Dynamo: dynamo
Ride: montar (en aquest cas en bici)
Reread: rellegir
Make sense: tenir sentit
Fill in (phv): omplir, generalment una taula o formulari

UNIT 2 – THE GENERATION OF ELECTRIC POWER

2.1 INTRODUCTION

We already know what energy is, and that it can be transformed. Unit 2 is about a very useful and important energy type: electric energy. We will learn how is produced and distributed to our industries, cities and homes.

ACTIVITY 2.1 – Electric energy in my life

Work in pairs and make a list of 5 different situations in your daily like where electricity plays an important role. Justify your answers.

There is an example for you already done.

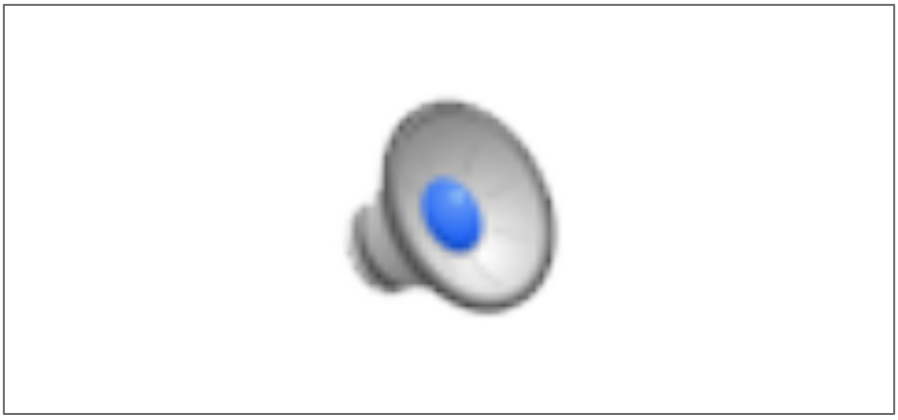
	Situation	Why…?
1	Use my laptop to surf the internet	Laptops use the electricity stored in their batteries
2		
3		
4		
5		
6		

Table 2.1: Electricity in my daily life

2.2 Generating electric energy

Electric energy is produced at power stations. Power stations use energy sources to generate electricity.

Activity 2.2 – Electric energy. How it is produced?
Watch this video carefully and fill in the table with the missing information.



Video 2.1: The generation of electricity. From power station to your home
You can also watch this video clicking here

	Energy source	Power plant
1	Wind motion	_____ plant
2	Light coming from the Sun	Photovoltaic plant
3	Heat coming from the Sun	_____plant
4	Thermal energy produced by the combustion of substances like coal or oil derivatives	_____plant
5	Water motion	_____plant
6	Energy within the atoms	_____plant

Table 2.2: Classification of power stations by type of energy source

2.3 - Power stations: how do they work?

We will go now over the main kinds of power stations, having a look at how do they work and what are their main parts.

2.3.1 Eolic power station

An eolic power station is made up by a set of generators which transform eolic energy into electric energy.

Picture 2.1: Eolic power plant of Trucafort, in El Priorat. (Catalunya)

Watch know this video which describes the parts of an Eolic generator and do activity 2.3 individually.

Video 2.2: Eolic generators, how do they work?
You can also watch the video clicking here

Activity 2.3. Parts of an Eolic generator

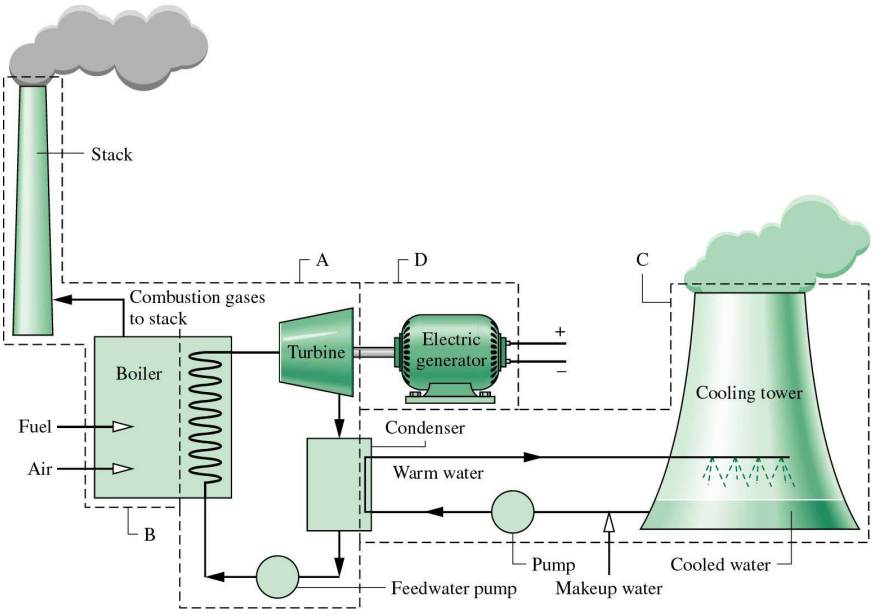
Match the different parts of an Eolic generator to their function:

Part		Function	
1	The blades.....	a)	....transforms mechanical energy into electric energy
2	The step up gear…	b)	....gives information about the wind speed and wind direction
3	The generator.....	c)	...increases the torque over the secondary shaft
4	The wind detector....	d)	...capture the wind, making the main shaft turn

2.3.2 Thermal power stations

As we know, thermal power station use the heat generated when burning substances like coal, gas or oil derivatives to generate electricity.

Watch this diagram carefully…



Picture 2.2: Diagram of a thermal power plant

Thermal power stations. How do they work?

The combustion of fuel (like gas, coal or oil derivatives) generates heat in the boiler which makes water evaporate. The generated steam moves the turbine which in turn moves the electric generator producing electric energy.

Steam is recycled by a cooling tower which cools down the steam so that the water produced can be reused again and again to generate electricity.

Activity 2.4 – Thermal power stations…is it true or false?

What do you guys think of this statements about thermal power plants. Are they true (T) or false (F)?

1. The boiler contains the combustion of fuel.
2. Thermal power plants do not require water.
3. Turbines transform mechanical energy into electricity
4. The steam coming out of the cooling tower is the same as the steam recycled.

Activity 2.5: The effect of thermal power stations in the ecosystem

Look at the diagram of the thermal power plant again and answer these questions:

What do you think that comes out of the stack? Do you think that this waste can have a negative effect in the ecosystem? Which one?

Activity 2.6. – Find out….where is this thermal power station?

The thermal power plant is located in _____ and it is called _____

2.3.3 Hydroelectric power plants

A hydroelectric power plant uses the motion of water to generate electric energy. These are located at artificial water reservoirs.

Picture 2.4: Hydroelectric power plant of Riba Roja .
Comarca de Ribera d'Ebre. Catalunya.

Activity 2.7 – Hydroelectric power plants….how do they work?

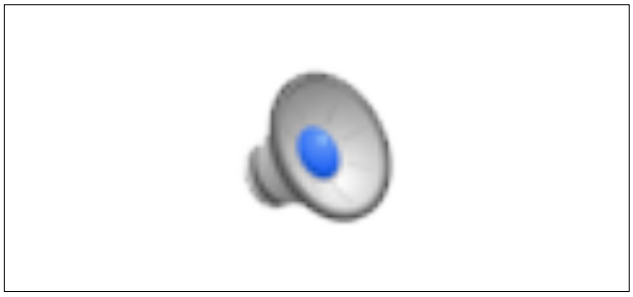
Work in pairs and try to figure out what can be the way hydroelectric power plants generate electric energy. What different parts do you think that there must be?

Sketch up now a possible hydro electrical power plant. Do not forget to name their parts. You can do this in Catalan.

Sketch 2.1. We believe that a hydroelectric power plant is like this.

Watch now this video about the functioning of a hydro electrical power plant like the one of Riba-Roja.

.



Video 2.4: Hydroelectric power plants. How do they work. You can also watch the video cliking here

Answer these questions:

What differences are there between your sketch and what you know now about the functioning of hydroelectric power plants?

Why are there these differences? List the things you have not had into account.

Do you think there are things in common between thermal and hydroelectric power plants? What is similar? And what is different?

Having in mind the video you have just watched, do the sketch-up of a hydroelectric power plant. Bare in mind all you know now!

Pros and cons in hydroelectric power plants

Like any other technology, hydroelectric power plants have pros and cons

Pros		Cons	
1	Do not require fuel to work.	1	Impact on the ecosystems due to water reservoirs
2	Do not emit CO2 into the atmosphere.	2	Relocation of towns due to the construction of water reservoirs.

2.3.4 Nuclear power plants

Nuclear power plants use the energy within the atoms to generate electric energy.

Picture 2.5: Nuclear power plant in Vandellòs (Tarragona, Catalunya)

Nuclear power plant function like thermal power plants, but instead of using coal or oil derivatives to generate thermal energy, they use a special fuel called uranium which is used to heat up water to move the turbines and the electricity generator.

Watch this video and find out the different parts which make up a nuclear power plant like the one in Vandellòs.

Video 2.5: Nuclear power plants. How do they work? You can also watch the video clicking here

Activity 2.8 – The nuclear power plant

Have a look at the following table and match parts in a nuclear power plant to their function.

Part		Function	
1	The reactor can be found in the primary circuit….	a)	...is the steam generator
2	The nuclear reaction which heats up water…..	b)	...by the turbines and the generator
3	In the secondary circuit…..	c)	...increases the water temperature and pressure.
4	Electricity is generated…..	d)	...uses uranium as fuel
5	The water from the river nearby it's used to….	e)	...cools down the steam to turn it into water and recycle it

Pros and cons of nuclear power plants

Activity 2.9 - The accident at the Vandellòs nuclear power plant

Read the following text on the nuclear power plant of Vandellòs and answer the questions. Did you know that some years ago there was an accident?

The accident at Vandellòs nuclear power plant happened on the 19th October 1989. A fire started at the electric system facilities of the plant and became so important that put in danger the reactor.

This was the most dangerous accident in Spain. It posed a risk for the population living nearby.

The fuel that the power plant uses generates waste which are difficult to manage. The main component that is found in this waste is Carbone 14 and has a lifecycle of more than 5000 years!. This makes very difficult to store it at the nuclear cementer in the El Cabril (Córdoba) where waste disposed there has a lifecycle of less than 300 years.

Answer now to this question:

What are the cons of nuclear power plants and why?

2.4 DISTRIBUTION OF ELECTRIC ENERGY

Think for a second: how does electricity get to your homes? What is the path that electric energy follows from the power plant? How is it possible that from a single power plant many homes and industries are supplied?

In this part of Unit 2, we will find out how electric power is distributed and transported to our industries, cities and homes.

But before we start, let's have a look at the different components that we need to distribute electric power.

Activity 2.4.1 - Basic components in the distribution of electric energy.

In the following set of pictures, only some of the components shown are used in the distribution of electricity. Tick them!

Gasoduct

Step down plant

Step down sub plant

Electric tower

Tester wires

Ventilation outlet

Let's have a look now at your intuition skills! Where you right?

Watch this video on the distribution of electric energy. Pay attention….which of the elements in activity 2.4 appear?

Click here to watch the video

Now is time to list the elements that are used to distribute electric energy and their function

Element	Function
Power station	Generates electricity from an energy source
Step down station	

You know now the basics on how electricity is generated and distributed! Congratulations!

Glossary – Language of learning

Power station/power plant (cn): planta de generació d'energia elèctrica
Photovoltaic (adj) : fotovoltaica
Eolic power station (cn): parc eolic de generació d'energia elèctrica
Blades (n): pales
Step-up gear (cn): multiplicadora
Generator (n): generador
Shaft (n): eix
Stack (n): xemeneia
Boiler (n): caldera
Turbine (n): turbine
Electric generator (n): generador d'electricitat
Cooling tower (n): torre de refrigeració
Pump (n): bomba d'aigua
Condenser (n): condensador
Makeup water (n): aigua recuperada
Hydroelectrical power plant (cn): central de generació hidroelèctrica
Path (n): camí
Gasoduct (n): gaseoducte
Step-down plant (cn): estació de conversió
Ventilation outlet (cn): sortida de ventilació
Tower (n): torre

Glossary – Language for learning

Kinds of: tipus de….
Bare in mind: tingues present
Sketch-up (n): croquis
Pros and cons: avantatges i inconvenients
Work in pairs: treballeu en parelles
Match (v): relacionar

UNIT 3 – SUSTANIBALITY AND ENERGY SAVINGS

3.1 – The production of electric energy and its impact on the environment

Do you guys remember the thermal power plant? We know now that one of his parts emits gases to the atmosphere….what part was it?

It was the _____

Activity 3.1 - Ashes in the sky

This is the trailer of the movie *Ashes in the sky* (2008) directed by José Antonio Quirós. It tells the story of a small town in Asturias where there is a big electric power plant.

Watch the video carefully and answer the following questions:

Trailer of *Ashes in the sky*. You can also watch the video clicking here

1. **What kinds of power plant is it?**

2. **Take a minute to briefly describe the area where it is located. Is it an urban area? What makes you think so?**

3. **What problem do you think that the power plant poses? Why?**

4. **At the end of the trailer the following message is given: '*There are things worth fighting for'*. What do you think this message means? Please elaborate your answer.**

3.2 - Renewable and non-renewable energy sources

As we already know, thermal power plants use fuel which is limited on Earth. Moreover, the combustion of this fuel generates gases, such as CO2, which are not good to our environment as cause the atmosphere to progressively overheat.

Activity 3.2 Renewable and non renewable energy sources

Read carefully this text and circle the correct word

Raw materials such as coal and oil derivatives come from sources on Earth and therefore they're *limited/unlimited.* Pollution generated by thermal power plants *poses/doesn't pose* a problem for the environment nearby.

Power plants like Eolic, solar and hydro electric use renewable/non renewable resources, that's it, when we use them, their availability on Earth doesn't change.

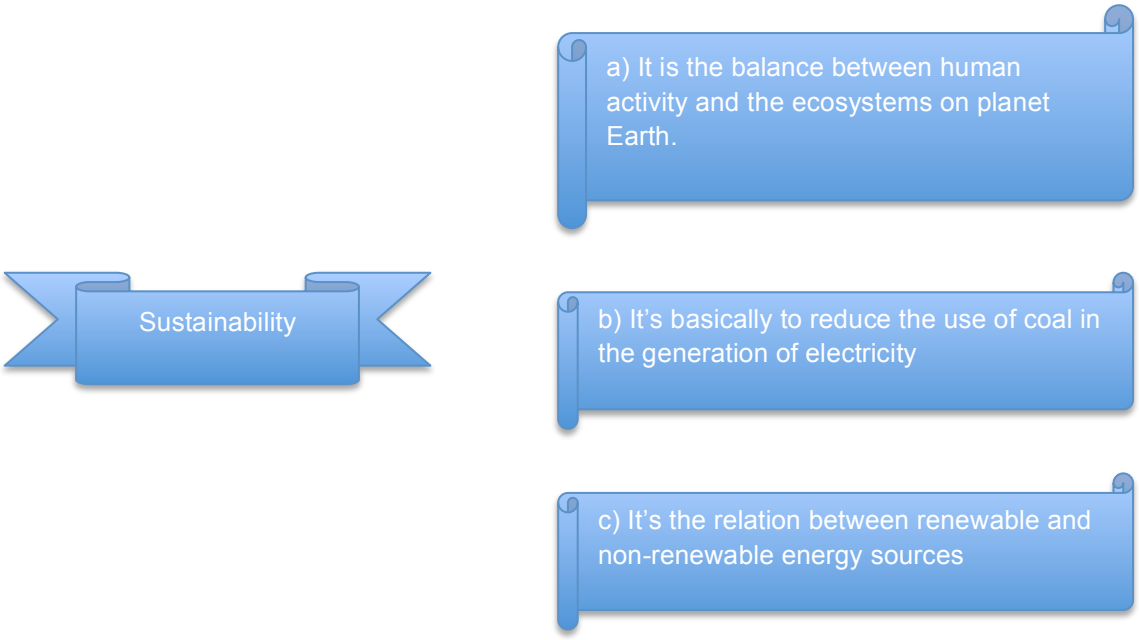
Think of it!

What effects do you think that all non-renewable energy sources may have on planet Earth. Give 3 examples and justify your answers.

3.3 - What is sustainability?

We know now that some power plants have an undesirable impact on the environment. We will now find out what do we understand by sustainability and how is related to what we know about energy sources and electricity generation.

Have a look at this drawing and do the matching individually:



Activity 3.4 – A role play game. 'Mayor for a day'

Imagine that your are know the mayor of the small town in Asturias of the film *Ashes in the sky.*

What would you do to improve the sustainability of your town? You can choose from the next options

1. Close down the thermal power plant, giving the sack to most of the neighbors in the town
2. Propose to close down the power plant, and replace the production of the electricity by using a small nuclear plant not far away
3. Propose the installation of aero-generators in town without taking any action on the thermal power plant.
4. You can also propose a different option, if you think that it's of interest.

As the mayor of the town, you are to announce your decision to your neighbors. Take 5 minutes to think about your speech and be ready to have a debate with everyone in the town.

Your teacher will give you directions and organize the debate. Be ready to defend your ideas having in mind what you know about renewable an non-renewable energy sources and sustainability.

3.4 – Energy savings and sustainability

Energy savings consist of a series of strategies that we can do to lower the energy consumption and therefore reduce the impact that some power plants have on the environment. The less energy we use, the less impact to the planet!

Activity 3.5 – My energy saving strategies

As members of society we all can do something to improve sustainability!. Have a look at the following options. Do you think that they help reduce the energy consumption? Do they improve sustainability?

	Strategy	Energy savings	Sustainability
1	Switch off lights when not used…		
2	Use low consumption bulbs		
3	Recycle		
4	Use a fridge which needs less energy		
5	Use public transport		
6	Keep my district clean		

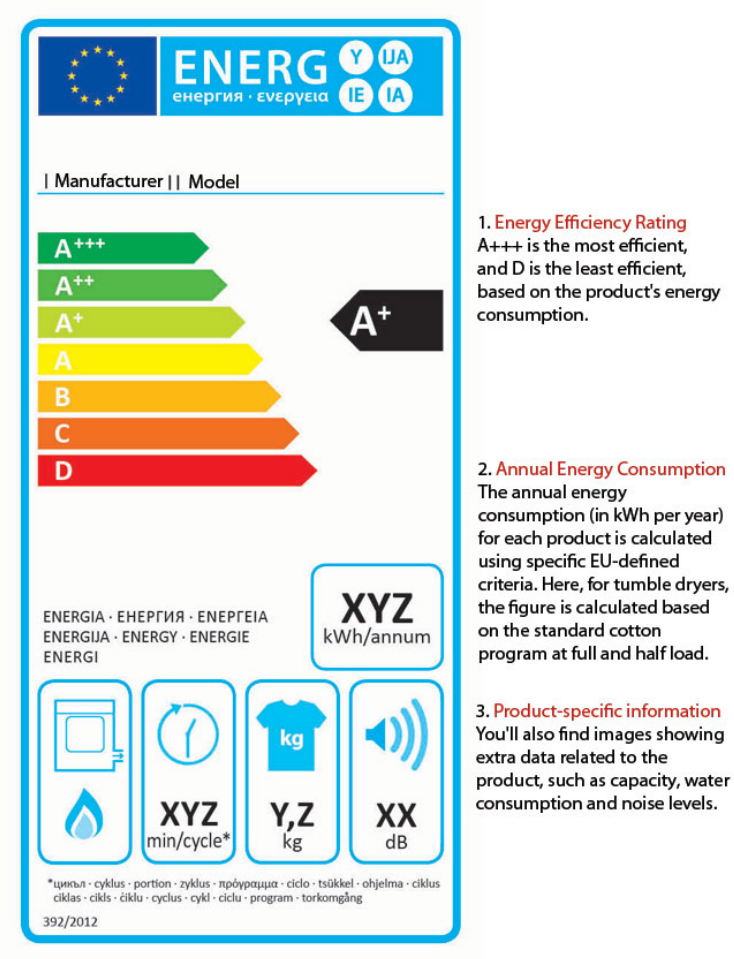
Which of these strategies do you currently do and which don't?. Why?

3.5 – Energy labeling

As you know, one of the strategies that we can use to save energy is to use electric appliances at home which require less energy to do their job.

The energy labeling show in a visual way the energy that an electric appliance requires to work in relation to its features. It is important to choose appliances with good energy ratings when we decide to buy one, so we help the environment with a sustainable strategy.

Look at the following energy label. What appliance do you think it is? What makes you think so?



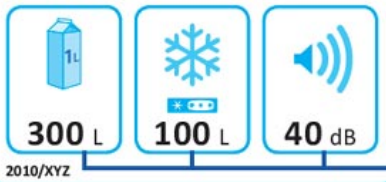
1. Energy Efficiency Rating
A+++ is the most efficient, and D is the least efficient, based on the product's energy consumption.

2. Annual Energy Consumption
The annual energy consumption (in kWh per year) for each product is calculated using specific EU-defined criteria. Here, for tumble dryers, the figure is calculated based on the standard cotton program at full and half load.

3. Product-specific information
You'll also find images showing extra data related to the product, such as capacity, water consumption and noise levels.

The appliance is a _____ , because _____

Activity 3.6 – Match the pictograms below with the information that they are providing us with:



Noise level	Capacity of the freezer	Capacity of the fridge

Activity 3.7 – Let's understand energy labeling

Take a good look at the energy label in the previous page and say if these statements are true or false?

1. A fridge classified as A+++ makes a greater contribution to sustainability that a A++ one.
2. If we want to contribute to sustainability it is best to buy fridges classified as C or D
3. When the capacity of the freezer increases, so does the energy that we need
4. The noise emitted by the fridge is related to its energy consumption

Activity 3.8

Find out what is the energy labeling of your fridge at home and complete the following table:

Brand	Model	Energy efficiency rating

Do you think that your fridge contributes to sustainability? Why? If the answer is no, what can you do to have a sustainable fridge?

Activitat 2.0 Tesla